

**SUBSIDENCE MONITORING REPORT  
1995  
STAR POINT MINE  
ACT/007/006**

**Cyprus Plateau Mining Corporation  
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## **INTRODUCTION**

During the months May through September, subsidence monitoring was conducted on surface lands above underground mining. The land surface above all full extraction mining was visually searched for evidence of surface disturbance. Monitoring points on the north half of the area above longwall panels 1 through 7, and 13 and 14, (Map 521.121e) have reached effective maximum subsidence and therefore were not surveyed in 1995. The monitoring points on the south half of this area have reached effective maximum subsidence and therefore were not surveyed in 1995. Monitoring points U1, U2, U3, U4, have reached effective maximum subsidence and therefore were not surveyed in 1995. Monitoring points U-5 through U-17 and GS-1 were not surveyed in 1995, these points have reached complete subsidence movement and do not need to be surveyed again. Monitoring points U-18 through U-32 have reached complete subsidence movement and therefore not surveyed in 1995. Monitoring points G1 through G63 (Map 521.121f) were surveyed for vertical movement. Monitoring points G-64 through G-94 were installed and surveyed ahead of mining.

Mining during 1995 was conducted in the areas shown on Maps W-4 and W-5, located at the end of this report.

## **SURFACE EFFECTS**

### **Longwall Mining Panels 1- 7, 13-14, 8-12 and 15 and 16**

Surface cracks, as shown on Map 521.121e, over longwall mining in Section 18, T15S, R8E, and Section 12, T15S, R7E, are associated with known faults in the south half and in the northeast quarter of Section 12, and with fractures in Section 18,

The cracks in the south half and in the northeast quarter of Section 12 originally varied in width from hairline to 6 inches, and displacement across the cracks varied from none to two feet. These cracks are continuing to heal nicely; there are not known open holes or unsafe areas. The cracks do not pose a safety hazard to humans, livestock or wildlife. The cracks in the northwest quarter of Section 12 developed during the winter of 1990; they vary in width from hairline to about 2 feet. These cracks were fenced during the summer of 1991 in compliance with the Manti La-Sal National Forest based upon site evaluation and recommendations.

Subsidence contours have been plotted using survey data in the Section 12 area. Monitoring in 1994 showed minimal new subsidence movement, the subsidence contours did not change from last year. As can be seen on Map 521-121e, subsidence contours reflect a reaction to the east-west trending faults. On the west side of Section 12, two short cracks appeared in 1989 at north-south trending faults. These cracks were very small, and have healed to a point where they are almost impossible to find.

Overburden in the Section 12 area ranges from 800 to 1,500 feet. The area is

characterized by a mounded ridge with a steeply incised canyon on the north end. Several areas of outcropping sandstone channels in Section 18 failed due to surface and near surface movement. No massive failures have occurred.

Overburden in the Section 18 area ranges from 0 to 1,100 feet. The area is characterized by a ridge at the north end with a cliff of exposed Castle Gate Sandstone. The majority of the area comprises the headwaters of a small drainage basin characterized by steep canyon sides and very rugged, tree covered terrain. Because the terrain in Section 18 is so rugged, a grid of monitoring points is impractical. Subsidence contours cannot be plotted for this same reason. The cracks in Section 18 vary in width from hairline to 60 inches; displacement across the cracks varies from none to 2 feet.

Cross sections have been plotted through Panels 1-7, 13 and 14 (Figure 1), Panel 2 (Figure 2), and Panel 4 (Figure 3). Cross Section F-F has been plotted of monitoring points U-18 through U-32 (Figure 10) showing the angle of draw at this location of 15 degrees. Please refer to Map 521.121e for cross section locations.

As can be seen on Figures 1, 2, and 3, subsidence has stopped above the longwall panels in the area of longwall panels 1-7 and 13 and 14. Subsidence reached its maximum during the third year after mining. Figure 1 shows the subsidence profile diagonally through the nine longwall panels. The progression of subsidence can be seen to the north as successive panels were mined.

A cross section through Points U5-U17 in Section 18 (Figure 4) indicates a maximum vertical drop of 3.4 feet. These monitoring points were not monitored in 1991 due to hazardous conditions but, were monitored again in 1992. They were not monitored in 1993 due to hazardous conditions. As can be seen on the cross section, mining of longwall panels 16 and 17 in the Third Seam caused additional movement.

Horizontal and vertical movement graphs have been made of monitoring points U1, U2, U3, and U4, Figures 5, 6, 7, and 8 respectively. Point U1, which is located directly above the north edge of longwall mining in the Wattis coal seam, shows the most vertical and horizontal movement. Point U4 which is located north of mining in the Wattis Seam and at the north edge of mining in the Third Seam shows the least movement.

A horizontal and vertical movement graph (Figure 9) has been plotted of monitoring point GS-1 near the stream in Section 18. Probably because of the shallow overburden at the GS-1 point location, maximum subsidence occurred within 15 weeks of the longwall face passing the point. This monitoring point was not surveyed in 1991 and 1993 because of the hazardous condition previously discussed but, was surveyed in 1992. Mining of the Third seam was approximately 220 feet away and appears to have had only minor additional impact on this point.

### Longwall Mining Panels 18 through 33

Mining in 1995 included about half of Panel 29, all of Panels 30, 31, 32 and most of 33 as shown on Maps W-4 and W-5, a very minor amount of pillar extraction in Section 23, T15S, R7E as shown on Map W-4; also Longwall development mining in Castle Valley Ridge Lease as shown on Map W-5.

Monitoring points G-1 through G-63 as shown on Map 521.121f were surveyed for vertical movement. Cross Sections D-D (Figure 11), E-E (Figure 12), G-G, and H-H were plotted from the data at these monitoring points. As can be seen on the cross sections, maximum subsidence is 5.33 feet at monitoring station G-15 feet. Subsidence at points Fox 2 and 3 is 5.50 feet.

As shown on Cross Sections D-D and E-E, the angle of draw at these locations is 26 degrees and 24 degrees respectively. Not enough data are available at Cross Sections G-G and H-H to calculate the angel of draws at these locations.

Subsidence monitoring of stations G-44 through G-63 is shown on the attached subsidence data sheets.

### MITIGATION

The surface cracks crossing the U.S. Forest Service development road in Section 12 were repaired in 1987, and have shown no further cracking, or movement.

A portion of the surface cracks near monitoring points U1 and U2 in Section 18 have been repaired to reduce the likelihood of accidents. The cracks were backfilled and the area fenced. Signs were placed in the area warning the public of the potential danger of the unstable ground. This area is fee land owned by the U.S. Fuel Company; Cyprus Plateau Mining Corporation has an agreement with U.S. Fuel which allows mining impacts. In the fall of 1995, the cracks were plugged with foam to provide additional protection to the public and provide a base for future backfilling.

The new cracks in the northwest quarter of Section 12 were fenced and danger signs placed to warn the public of the hazards. They are in a very rugged area where very few people travel.

### VEGETATION

Subsidence in the Section 12 area has caused minimal vegetation loss. Grasses, shrubs and trees near the cracks do not appear to be affected.

Some vegetation in Section 18 has been lost to the small outcrop failures. Natural reseeding is occurring and the area is reestablishing itself nicely.

## **SURFACE WATER AND GROUND WATER**

There has been no identified impact to ground water in the Section 12 area and there is no surface water in the area.

The Section 18 is the subject of a study of the effects of longwall mining on ground water and surface water; the study ran through 1992, with the final report completed in 1995. The study was undertaken in conjunction with the U.S. Geological Survey and the Division of Oil, Gas and Mining, the U.S. G. S. published the final report.

The stream in Section 18 (North Fork Right Fork Miller Creek) had continuous flow in July, but during the low flow period in October the flow disappeared between monitoring points M-2 and M-4 as shown on Permit Map 722.100d. The water reappeared below monitoring point M-4. The stream water was diverted into the mine near monitoring point GS-1 because of subsidence during mining in 1989. The stream at this location was small, about 6 GPM before mining. Springs and base flow from the canyon bottom recharge the stream below this point. A section of stream approximately 800 feet long appears to have been affected. An important point to be learned from the study is whether mudstones and siltstones will expand and stop the downflow of stream water. Water rights in the stream are held by U.S. Fuel Company, with which Cyprus Plateau has an agreement allowing impacts due to mining. Flow below the lower dry section begins again below monitoring station M-6 as shown on Figure 53, Map 722.100d, and at monitoring station M-8 the flow averaged 36 GPM from July to October, 1995.

A small side canyon to the North Fork of the Right Fork of Miller Creek in the southeast quarter of the northwest quarter of Section 12, monitoring station M-3, had a small flow prior to mining; the flow in this stream channel was diverted into the ground presumably due to subsidence in 1989. There was flow from the channel in early July of 1990, but no flow in September of 1990. In early July of 1991, there was a flow of 1.5 GPM coming from the channel again. The flow may be an indication that the mudstone and siltstones are healing, there was no flow in 1992 possibly due to the drought. In 1993 the side canyon was flowing again both in July and September. In 1994, this canyon flowed both in July and in September. In 1995, this canyon flowed both in July and in October. The wetter winter of 1992-1993, 1993-1994, 1994-1995 may have caused the side canyon to flow again. Additional time is needed to monitor this channel for flows to determine healing.

A complete discussion of hydrologic impacts can be found in the 1994 Annual Hydrologic Report.

## **SURFACE STRUCTURES**

The only impact to surface structures has been the settling of the U.S. Forest Service development road discussed previously in this report. Repairs to this road were made in 1987, and no further road damage has occurred.

## **MONITORING**

Monitoring in 1995 will include the following:

1. Survey monitoring points G-20 through G-94 above longwall panels 18 through 39, as shown on Map 521.121f and map 521.121g1. Install monitoring points above Longwall Panels 40 and 41 as shown on Map 521.121g1 on Castle Valley Ridge.
2. Visual observations of the ground surface above all mined areas for surface effects of mining.
3. Visually inspect the Wild Cattle Hollow stream west of longwall panels 18 through 30 for evidence of surface impacts from mining.

# FIGURE 1

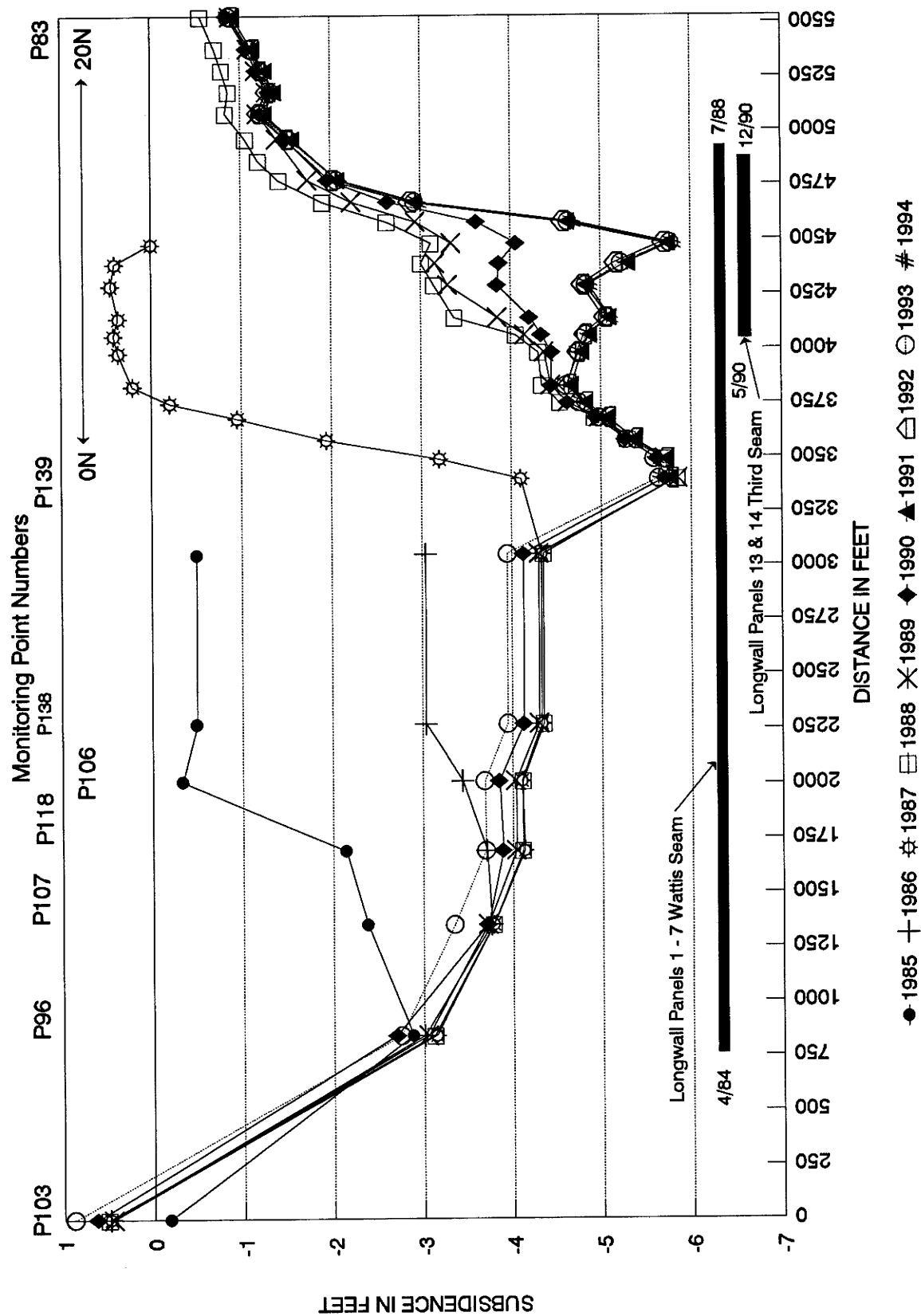
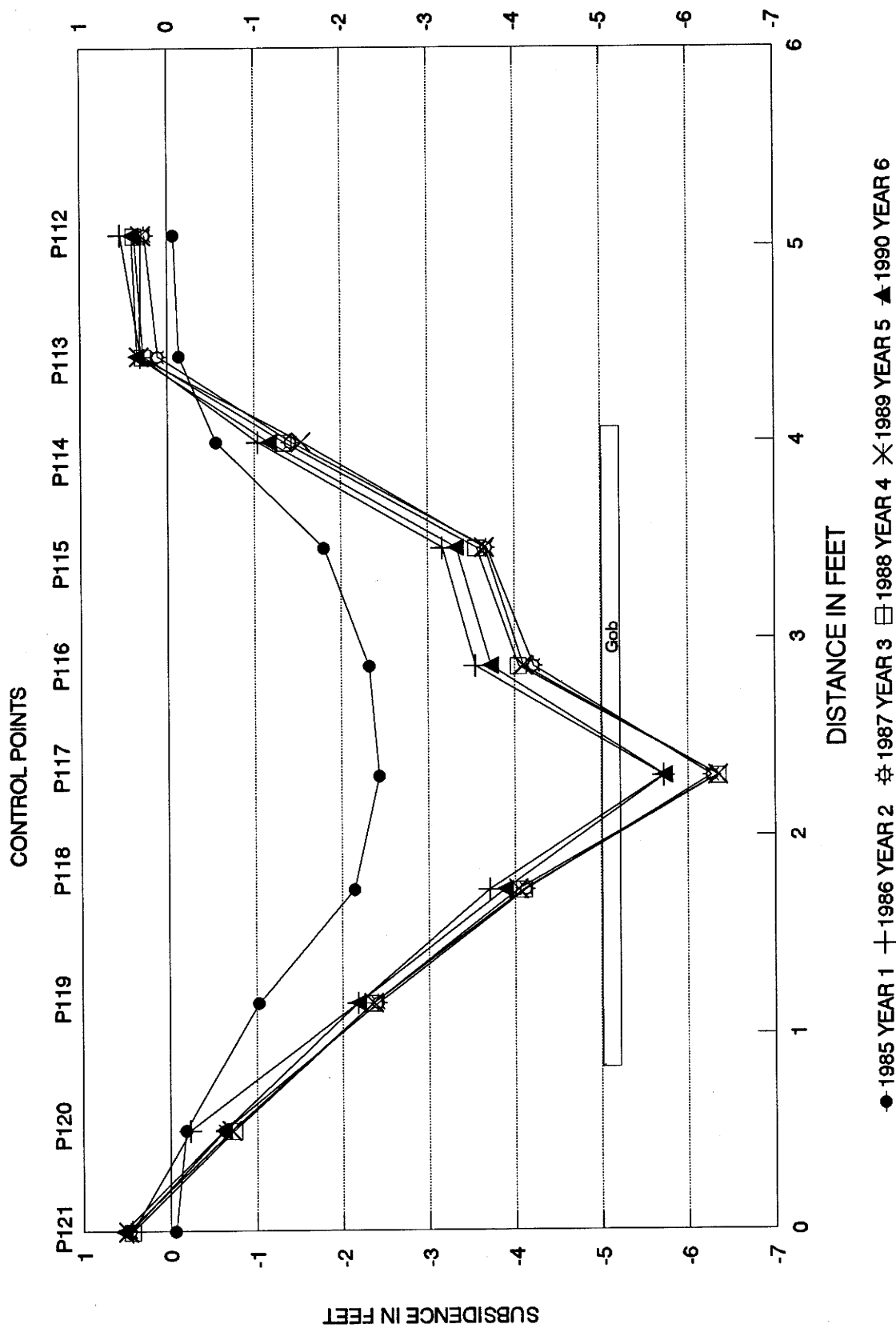


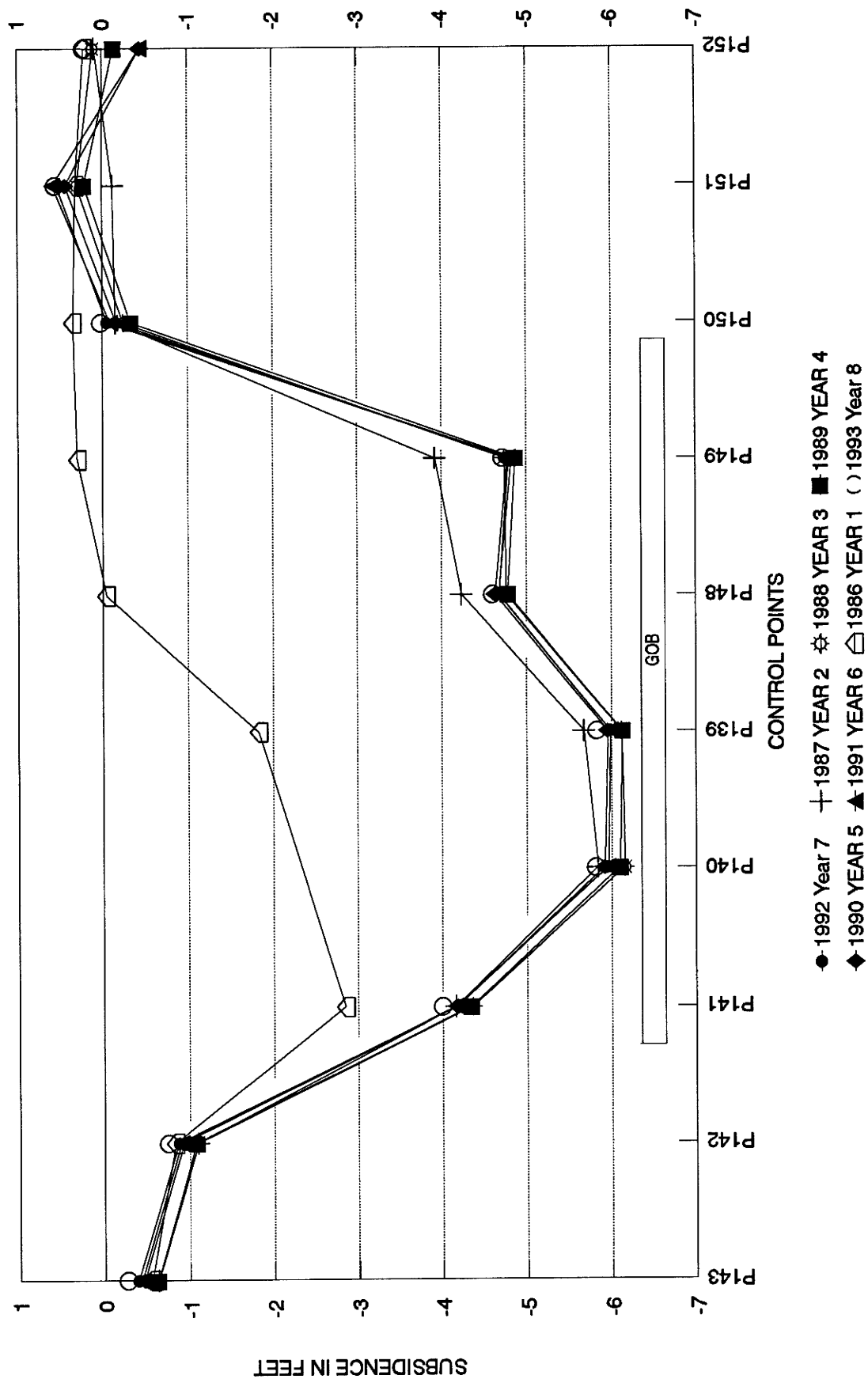
FIGURE 2  
CROSS SECTION B-B LONGWALL PANEL 2



1- Control points are not to scale horizontally - shown in relative position to each other.

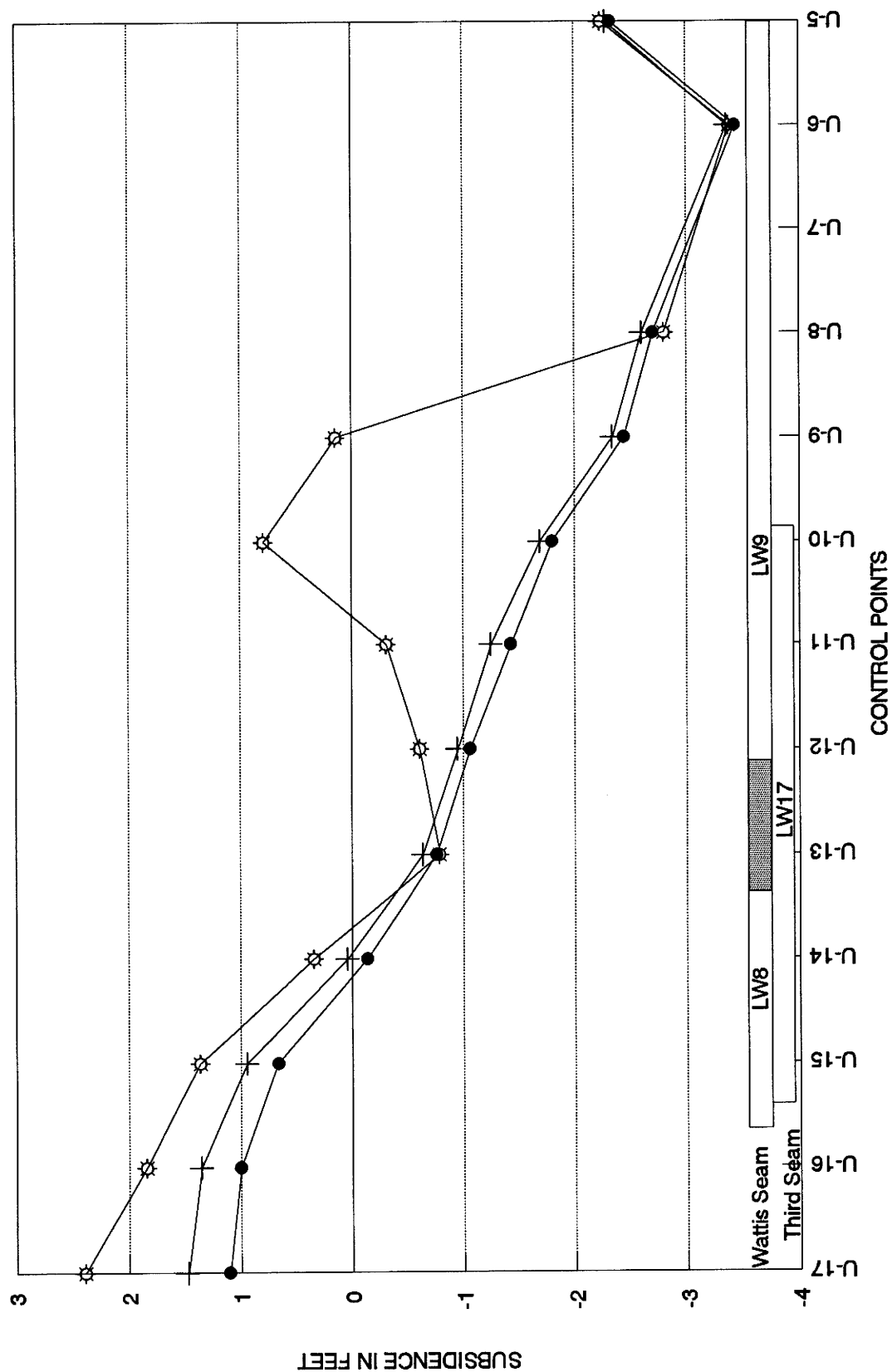


FIGURE 3  
CROSS SECTION C-C LONGWALL PANEL 4



1- Control points are not to scale horizontally - shown in relative position to each other.

# FIGURE 4 U-NORTH NEAR-STREAM PROFILE



● 1989 YEAR 1 + 1990 YEAR 2 \* 1992 Year 4

1- Control points are not to scale horizontally - shown in relative position to each other.

FIGURE 5  
U-NORTH SUBSIDENCE MONITORING  
HORIZONTAL AND VERTICAL MOVEMENT GRAPH  
STATION U1

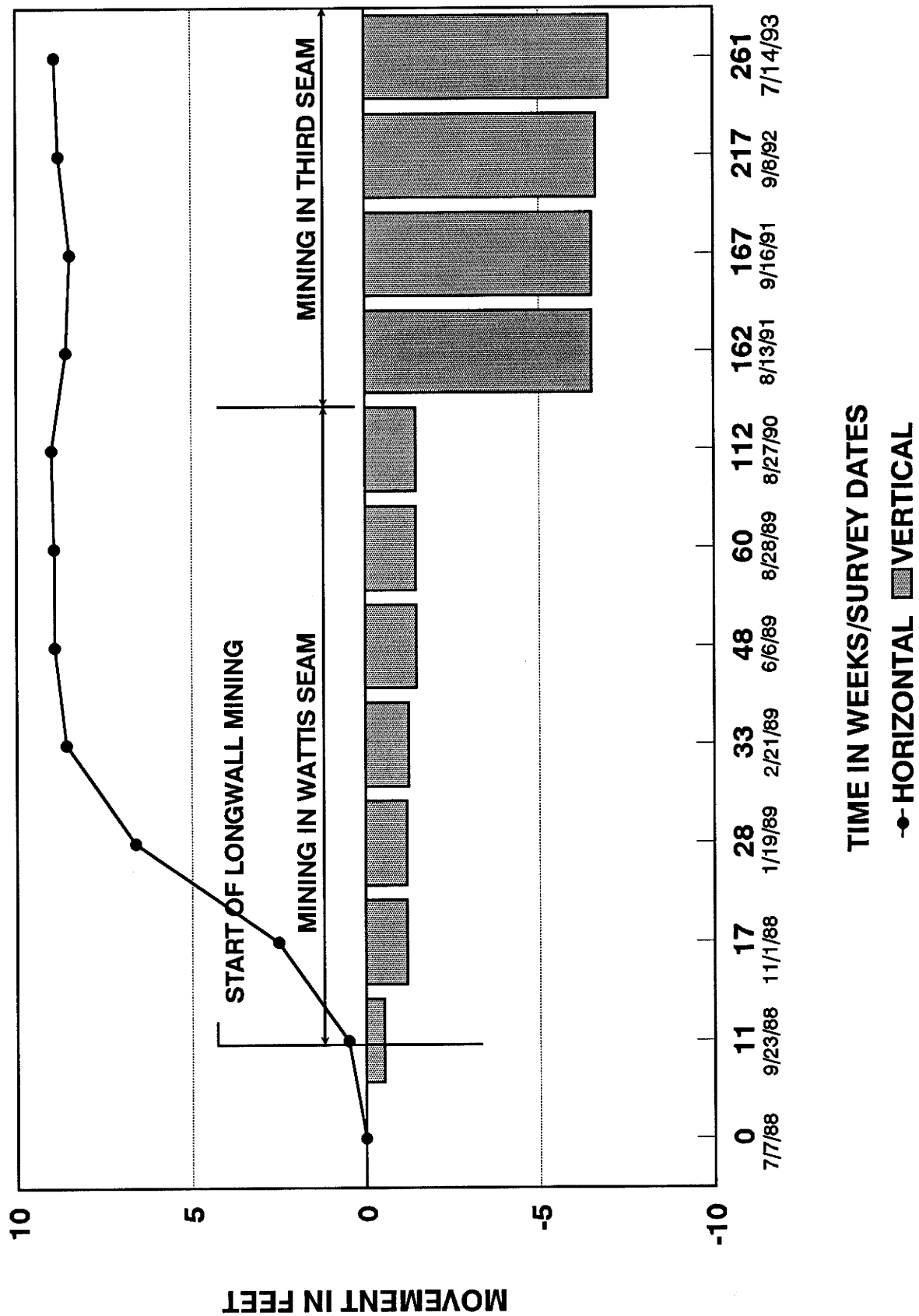


FIGURE 6  
U-NORTH SUBSIDENCE MONITORING  
HORIZONTAL AND VERTICAL MOVEMENT GRAPH  
STATION U2

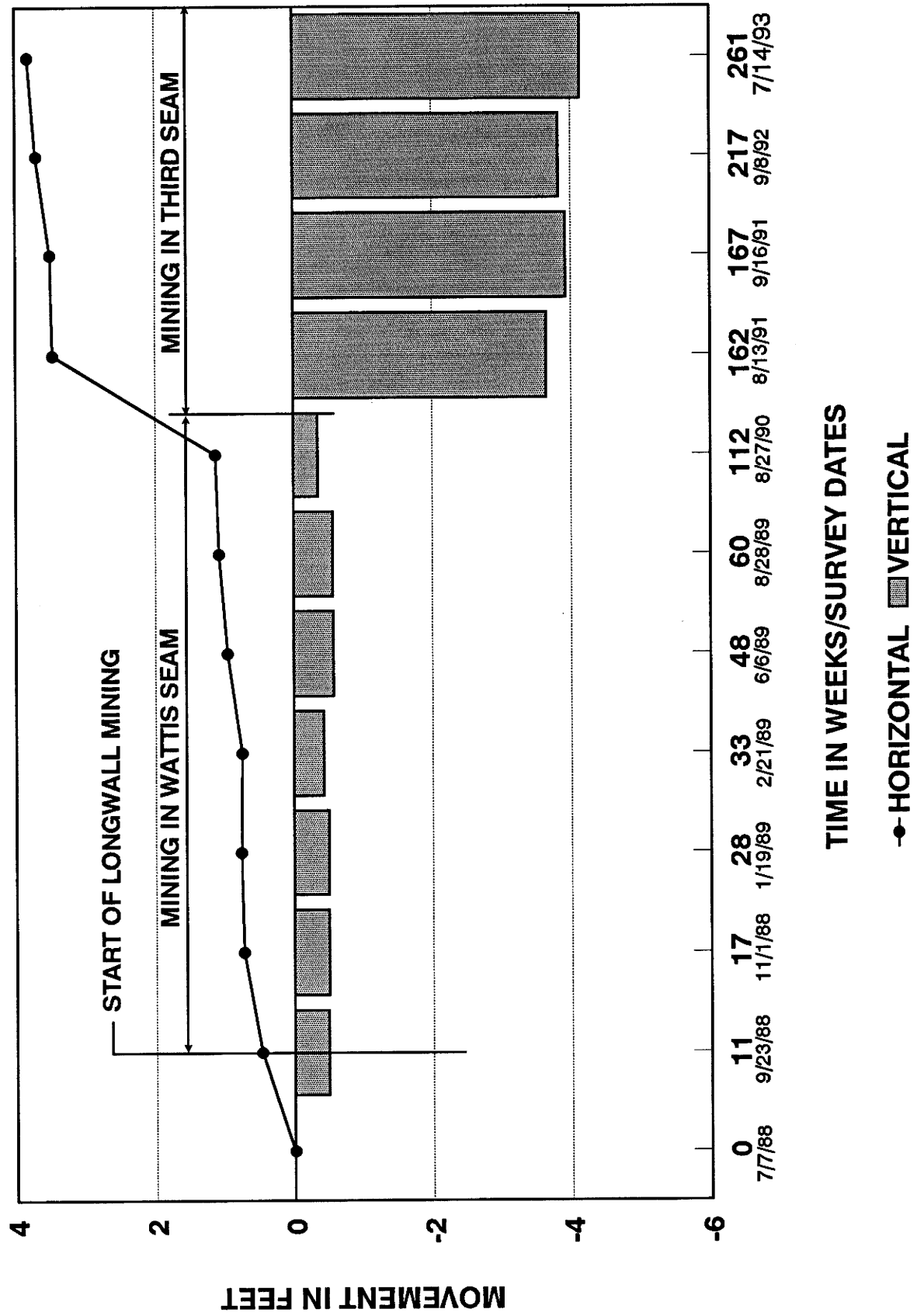


FIGURE 7  
U-NORTH SUBSIDENCE MONITORING  
HORIZONTAL AND VERTICAL MOVEMENT GRAPH  
STATION U3

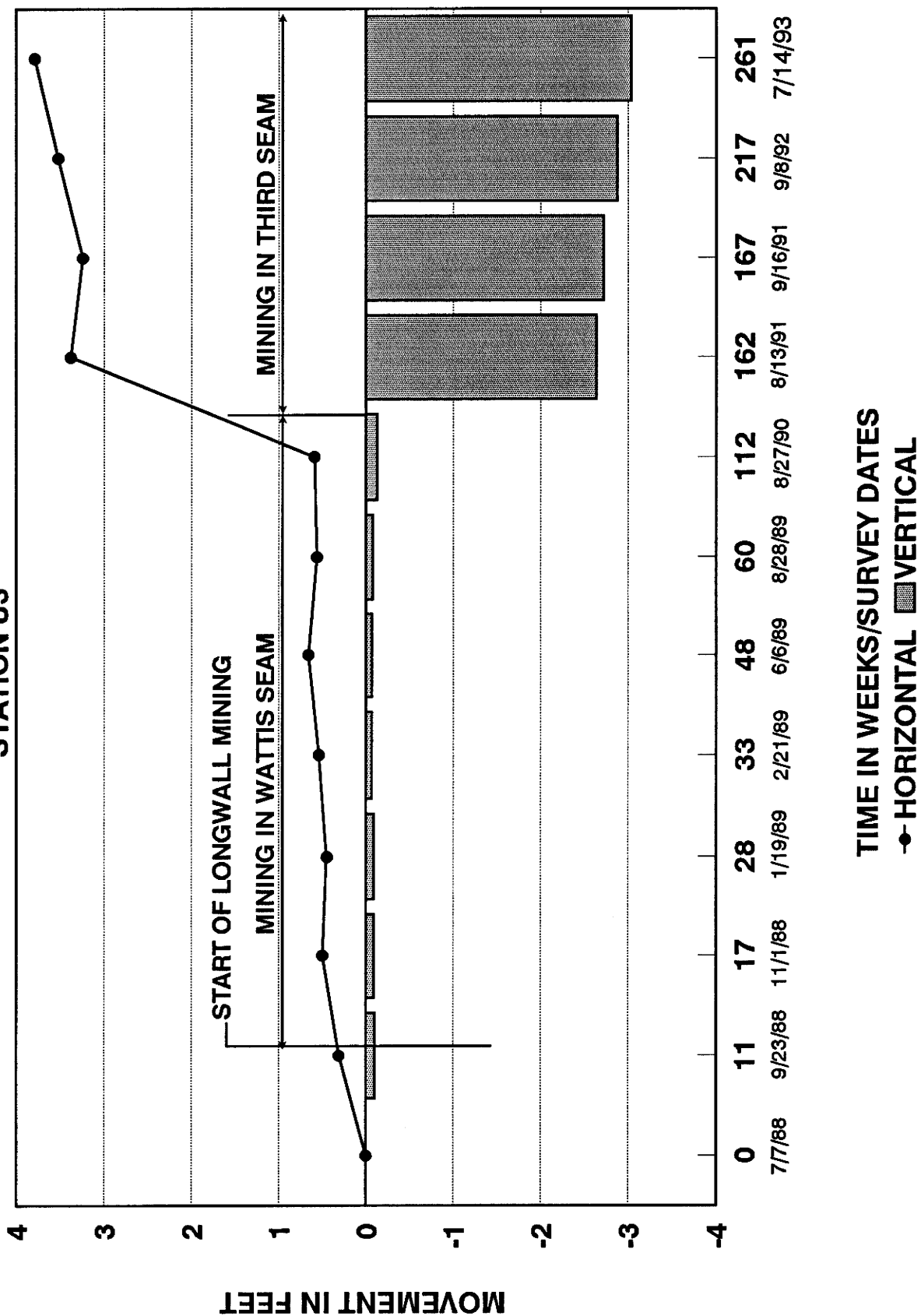


FIGURE 8  
U-NORTH SUBSIDENCE MONITORING  
HORIZONTAL AND VERTICAL MOVEMENT GRAPH  
STATION U4

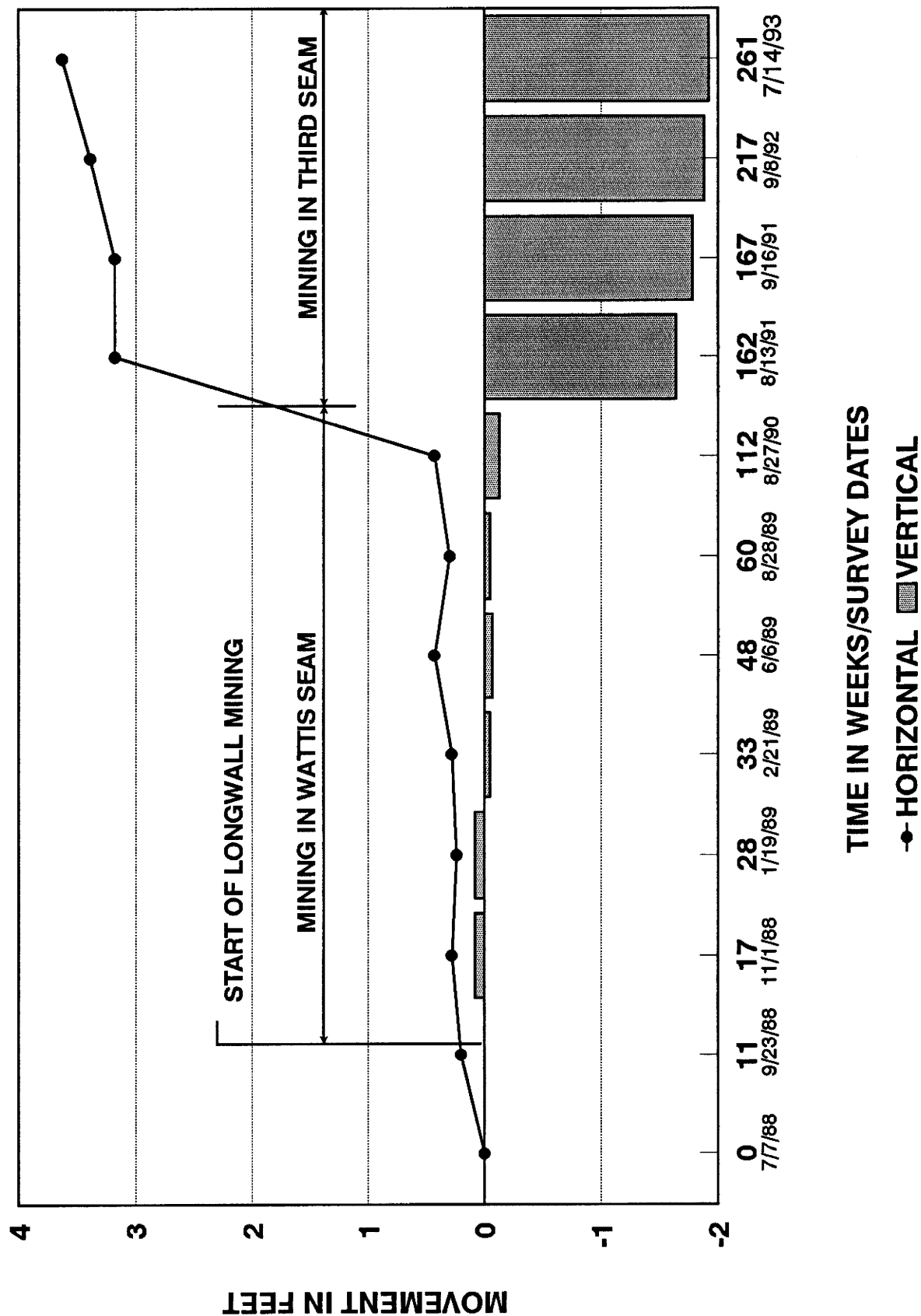


FIGURE 9  
STATION GS-1 U-NORTH  
HORIZONTAL AND VERTICAL MOVEMENT GRAPH

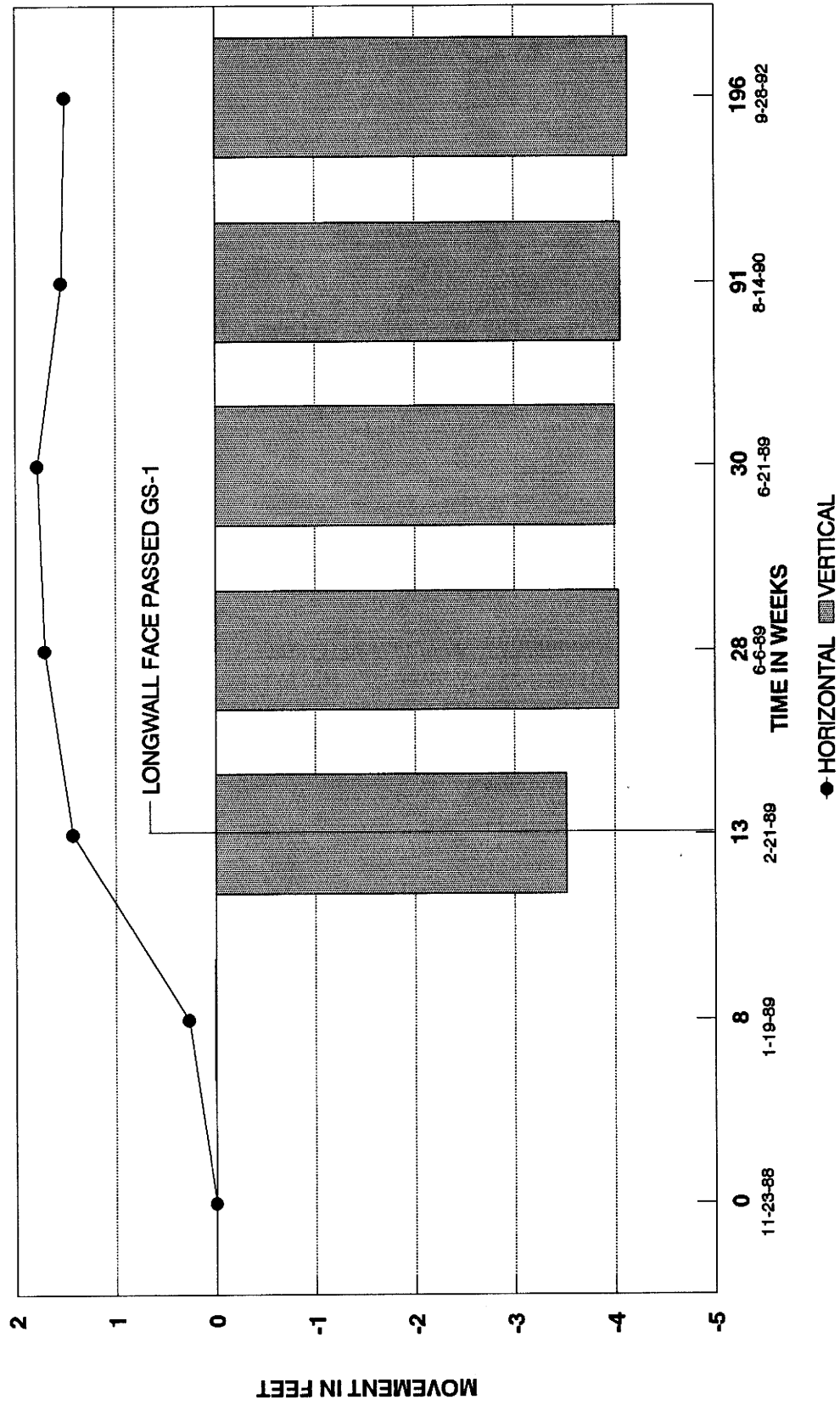
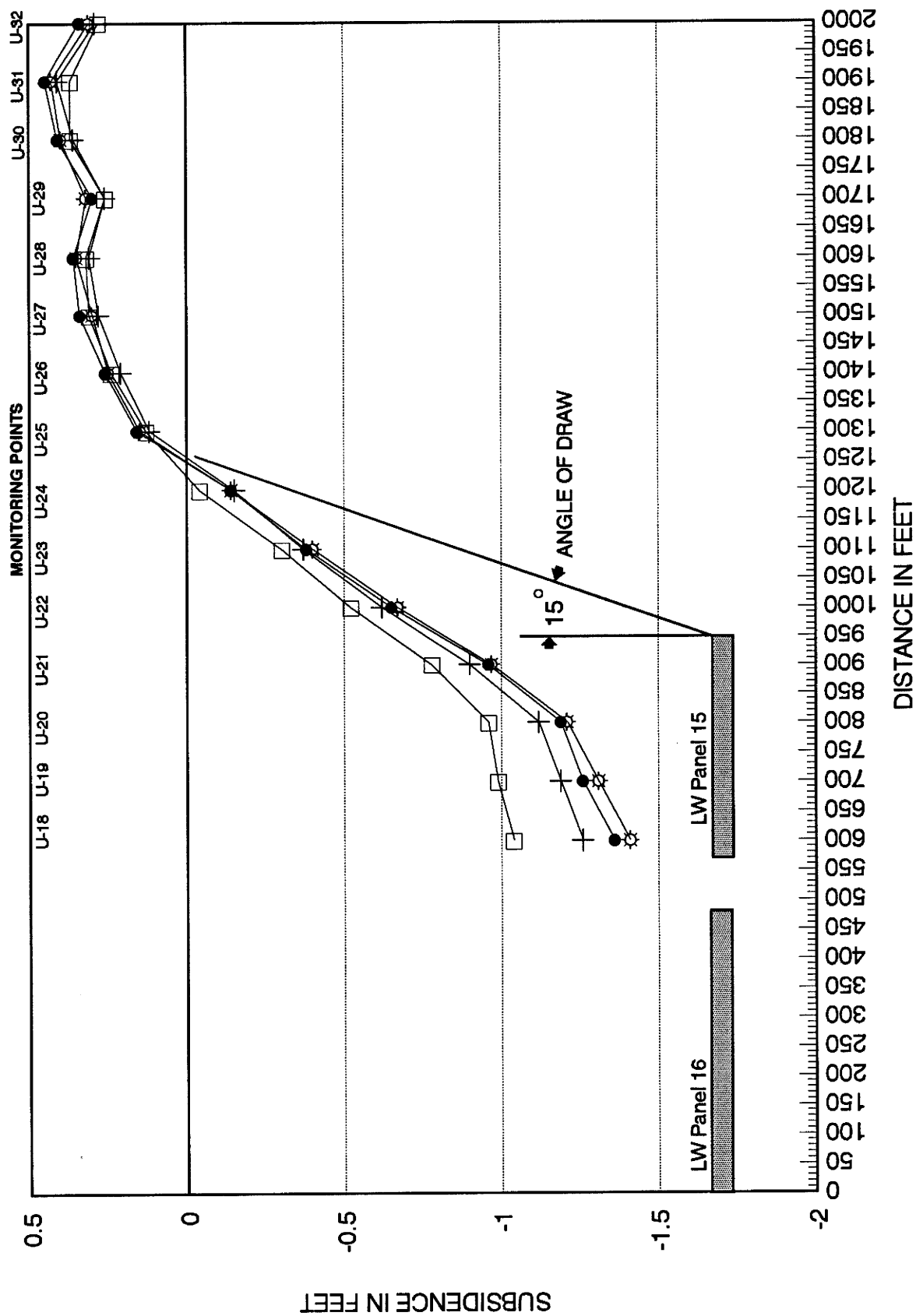


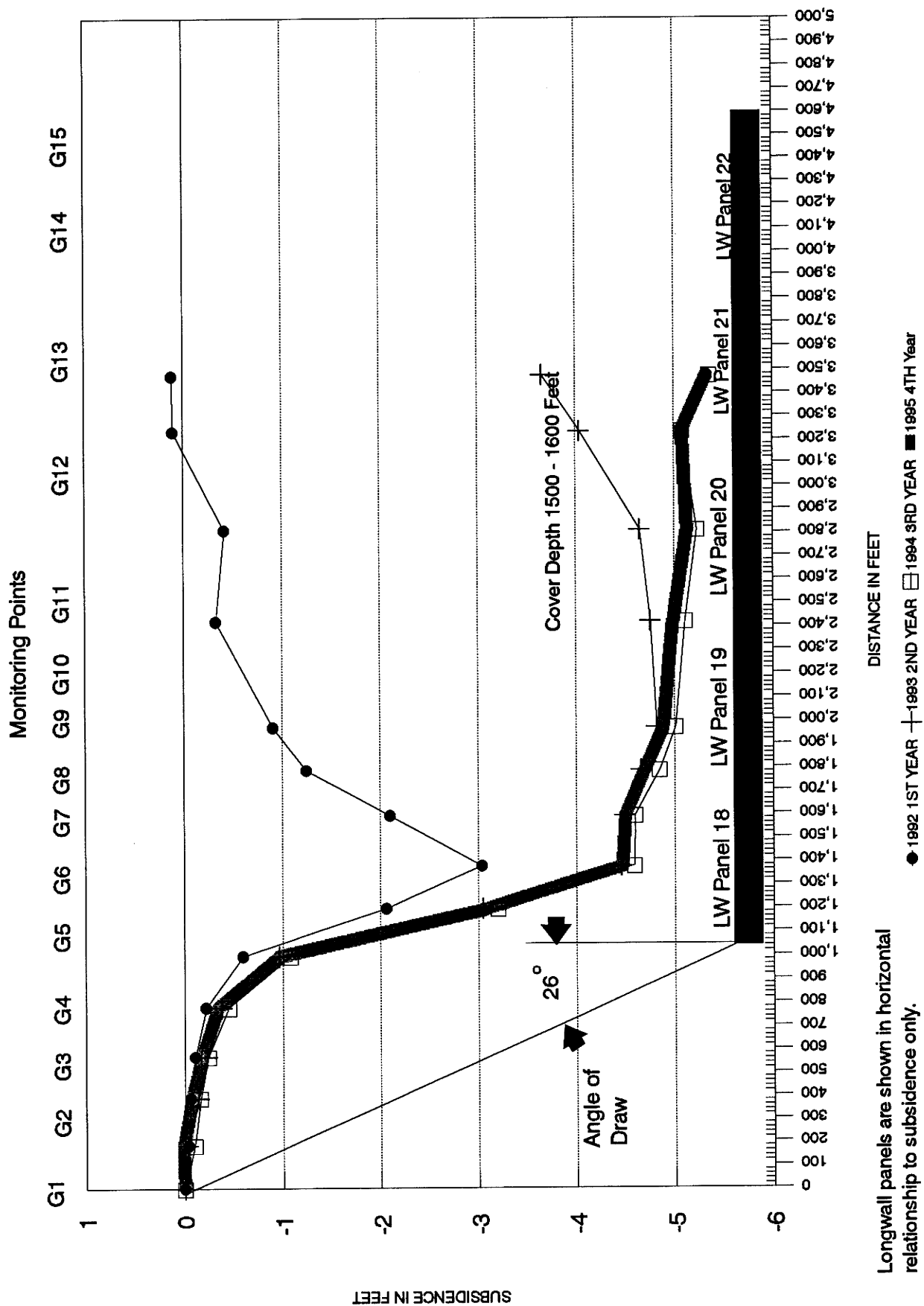
FIGURE 10  
CROSS SECTION F-F



□ 1991 + 1992 ● 1993 \* 1994



# FIGURE 11 CROSS SECTION D-D



Longwall panels are shown in horizontal relationship to subsidence only.

FIGURE 12  
CROSS SECTION E-E

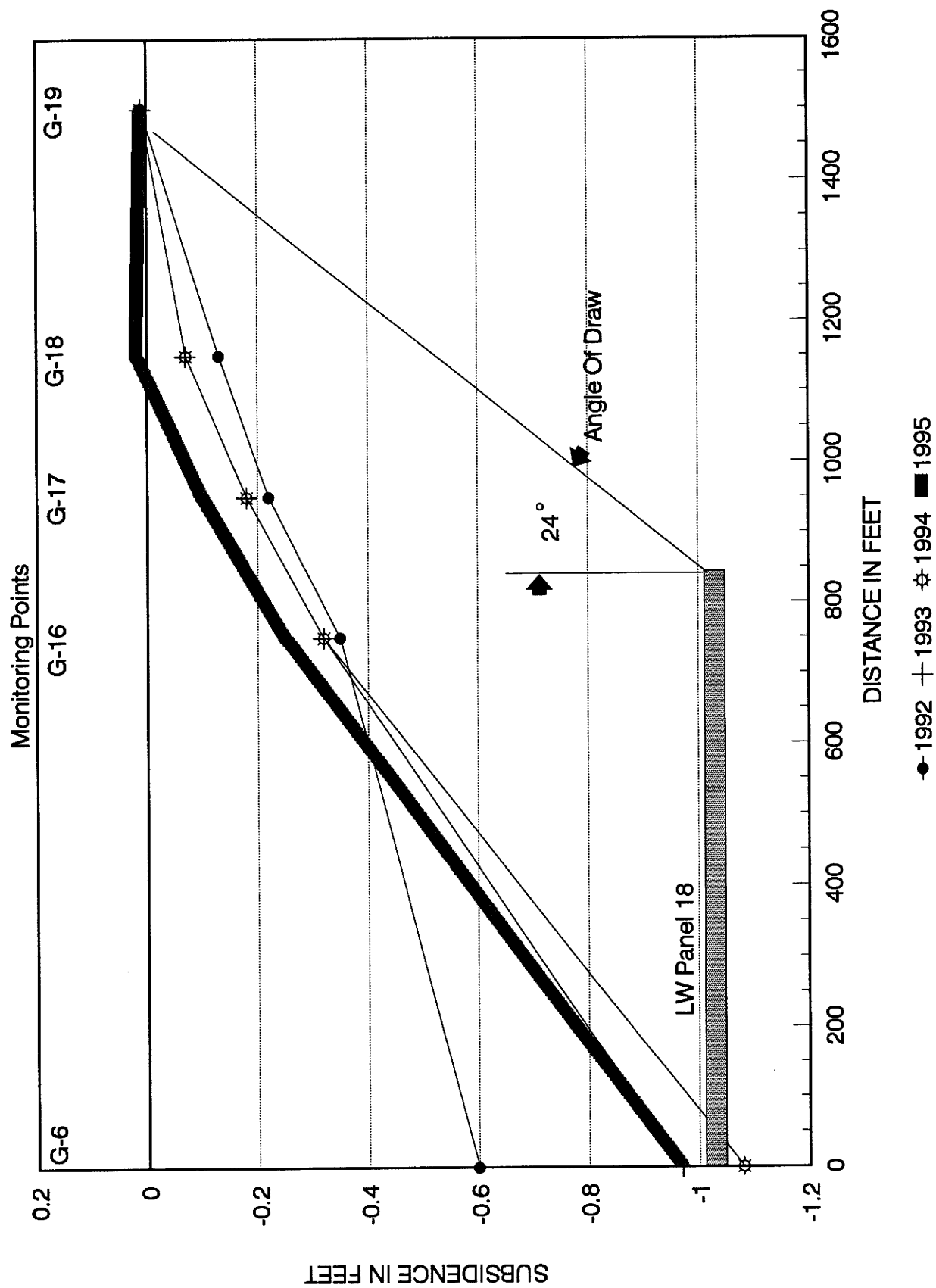


FIGURE 13  
CROSS SECTION G - G

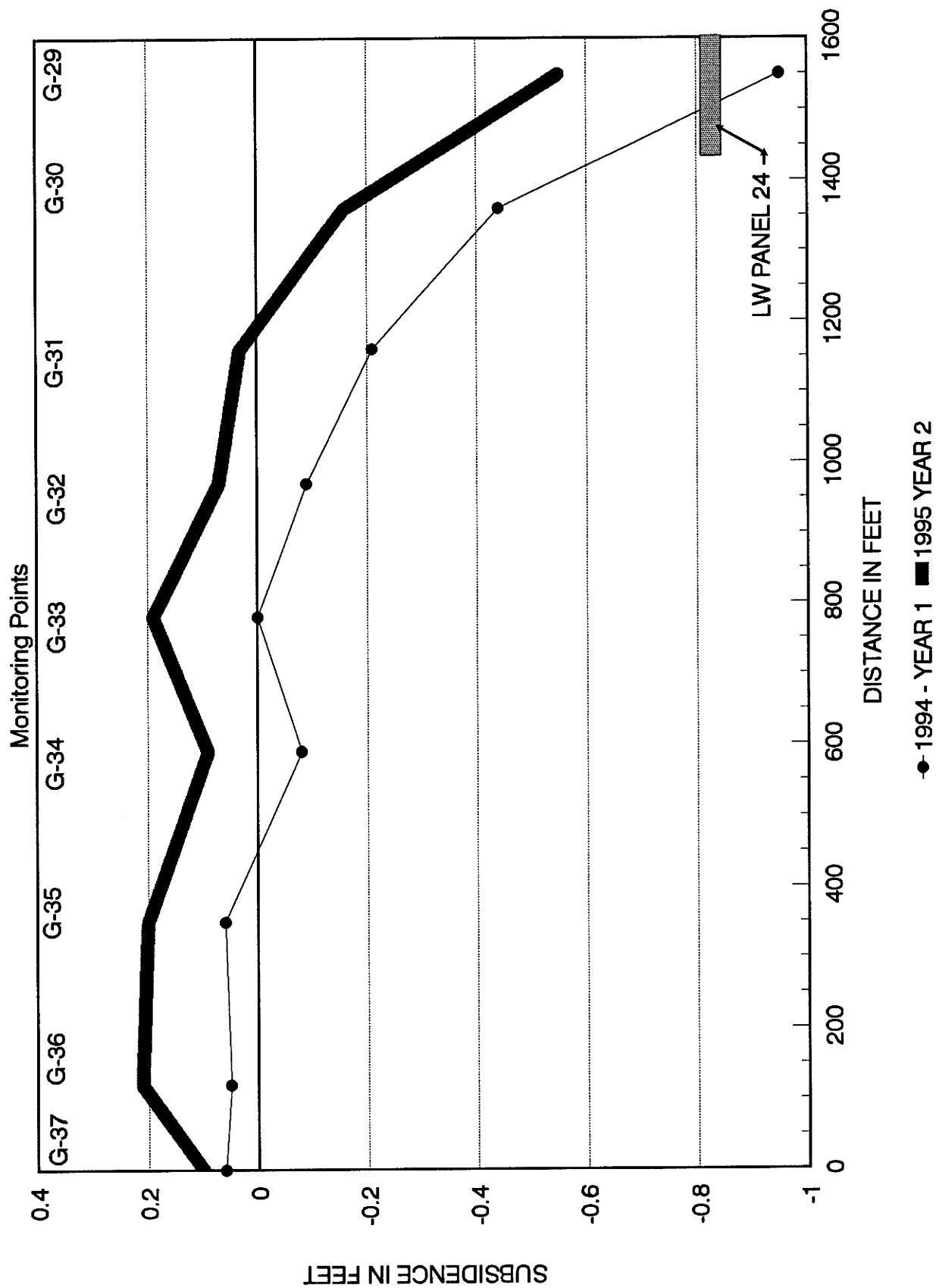
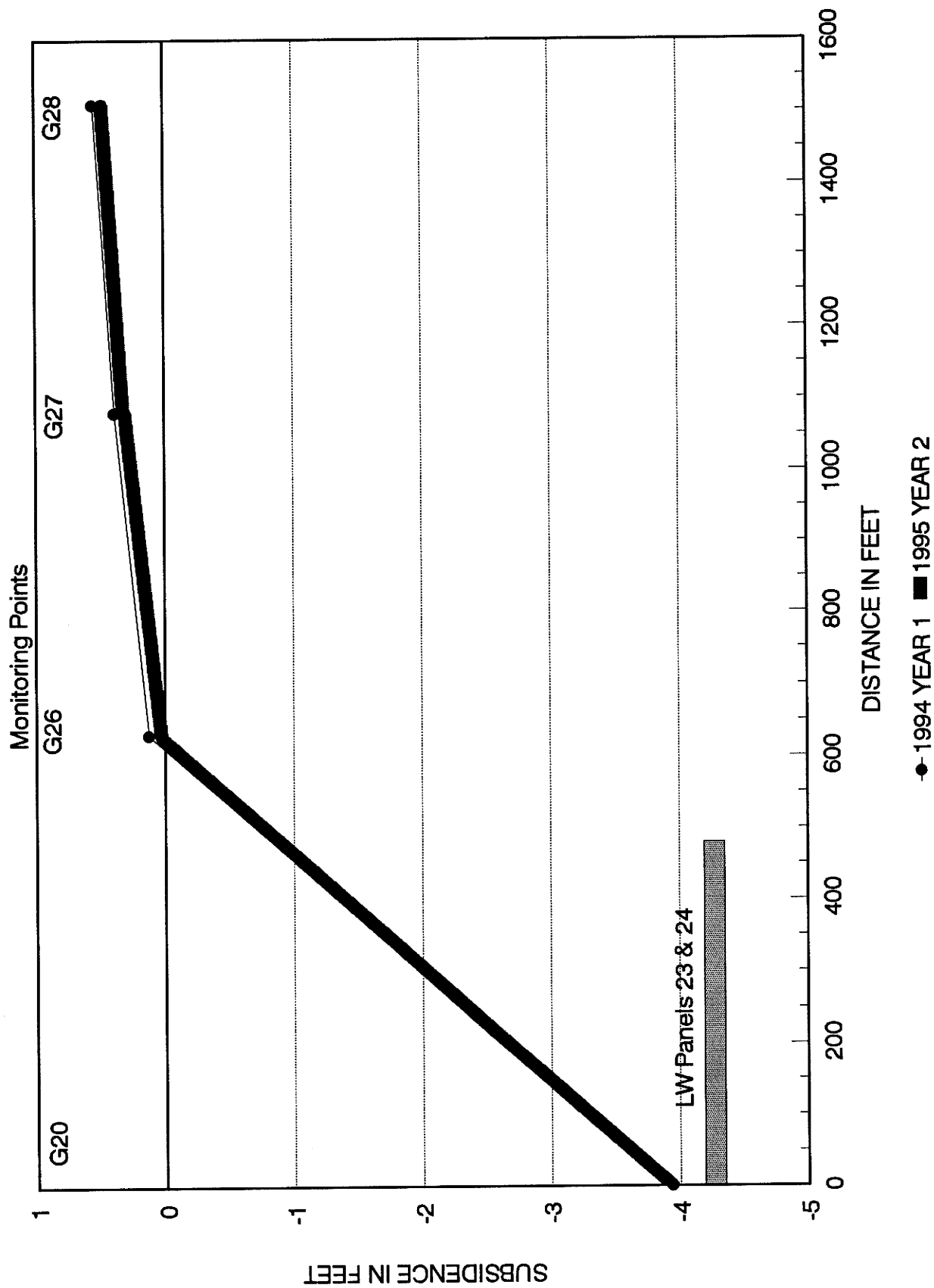


FIGURE 14  
CROSS SECTION H-H



CYPRUS-PLATEAU MINING CORPORATION  
SUBSIDENCE MONITORING ELEVATIONS

SUBSIDENCE MONITORING ELEVATIONS													SUBSIDENCE IN FEET										
STATION	ELEVATIONS										STATION	- INDICATES DROP IN GROUND SURFACE											
	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992		1993	1994	1995	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9
G31											9377.03	9376.82	9377.06	G31		-0.21							0.03
G32											9309.41	9309.32	9309.48	G32		-0.09							0.07
G33											9242.76	9242.76	9242.95	G33		0.00							0.19
G34											9164.21	9164.13	9164.3	G34		-0.08							0.09
G35											9078.66	9078.72	9078.86	G35		0.06							0.20
G36											9004.1	9004.15	9004.31	G36		0.05							0.21
G37											9045.63	9045.69	9045.73	G37		0.06							0.10
G38											9154.56	9154.38	9154.48	G38		-0.18							-
G39											9078.99	9078.91	9079.01	G39		-0.08							0.02
G40											8986	8985.96	8986.11	G40		-0.04							0.11
G41											8879.72	8879.74	8879.9	G41		0.02							0.18
G42											8903.57	8903.59	8903.75	G42		0.02							0.18
G43											8996.08	8996.03	8996.13	G43		-0.05							0.05
G44												9063.03	9063.03	G44		0.00							
G45												8965.48	8965.58	G45		0.10							
G46												8875.95	8876.04	G46		0.09							
G47												8804.53	8804.61	G47		0.08							
G48												8757.32	8757.37	G48		0.05							
G49												8845.44	8845.5	G49		0.06							
G50												9967.36	9967.18	G50		-0.18							
G51												9989.85	9989.68	G51		-0.17							
G52												10011.33	10011.37	G52		0.04							
G53												10032.26	10032.39	G53		0.13							
G54												10042.87	10043.05	G54		0.18							
G55												10065.51	10065.72	G55		0.21							
G56												10074.03	10074.2	G56		0.17							
G57												9985.23	9985.19	G57		-0.04							
G58												9943.89	9943.76	G58		-0.13							
G59												9862.16	9861.94	G59		-0.22							

CYPRUS-PLATEAU MINING CORPORATION  
SUBSIDENCE MONITORING ELEVATIONS

STATION	ELEVATIONS									SUBSIDENCE IN FEET													
	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	STATION	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9
-																							
G60												9750.39	9750.23	G60	-0.16								
G61												9625.96	9625.88	G61	-0.08								
G62												9527.41	9527.47	G62	0.06								
G63												9507.53	9507.56	G63	0.03								
G64																							

G60												9750.39	9750.23	G60	-0.16								
G61												9625.96	9625.88	G61	-0.08								
G62												9627.41	9627.47	G62	0.06								
G63												9507.53	9507.56	G63	0.03								
G64													9714	G64									
G65													9724.49	G65									
G66													9735.34	G66									
G67													9798.09	G67									
G68													9900.42	G68									
G69													9982.32	G69									
G70													10017.24	G70									
G71													10034.89	G71									
G72													10097.95	G72									
G73													10094.64	G73									
G74													10088.47	G74									
G75													10053.92	G75									
G76													9961.83	G76									
G77													9428.24	G77									
G78													9339.91	G78									
G79													9263.54	G79									
G80													9209.23	G80									
G81													9112.65	G81									
G82													9106.54	G82									
G83													9228.31	G83									
G84													9338.3	G84									
G85													9522.75	G85									
G86													9061.33	G86									
G87													9094.08	G87									
G88													9205.69	G88									